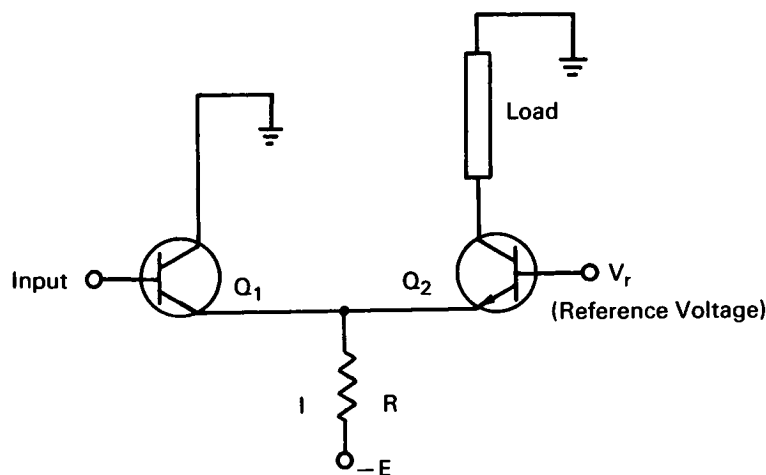


NASA TECH BRIEF



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Video Signal Processing System Uses Gated Current Mode Switches to Perform High Speed Multiplication and Digital-To-Analog Conversion



The problem:

To design a video signal processor to accept outputs from the digital computer in a visual spaceflight simulator and process them into a form suitable for presentation by the television display used in the simulator. Presentation of a view in the simulator requires that colors be assigned to the various displayed objects and textured surfaces and that surface textured patterns be faded out as a function of their scaled distance from the observer. The video signal system must be capable of accepting texture and color information in digital form and to combine these, for display on a color CRT, with analog information concerning fading.

The solution:

A video signal processor that incorporates special-purpose integrated circuits which use nonsaturating current mode switching techniques.

How it's done:

Digital color value numbers are converted to quantized analog signals by using the bits of the color number to switch discrete currents, which are made proportional to the fading signal amplitude, into the processor output stage. Signal rise time at the output of this digital-to-analog (D/A) converter is approximately 15 nsec. The processor output stage accepts the component currents, sums them, and converts the result to a voltage for driving a color CRT grid. Geometry of the output stage is arranged such that the conductors transmitting the component current to the summing point form a low impedance transmission line.

The video signal processor accepts inputs from the simulation computer and performs color selection, texture presentation, and fading. Inputs to the processor include:

(continued overleaf)

1. Texture Signals: Digital signals indicating whether surface foreground or background should be displayed on the CRT at a given instant.
2. Fading Signal: An analog signal proportional to range.
3. Object Color Selection Signals: Digital signals indicating which object face color, if any, is being presented at a given instant.

The fading information rate is relatively low (about 50 kc), but processing of texture and object color information must be compatible with 10 mc digital bit rates (rise times of 15 to 20 nsec).

Color signal amplitudes for the object faces and surface foregrounds and backgrounds are stored in the signal processing system as four-bit binary numbers. When the electron beam is scanning a particular face or surface on the CRT, color amplitude numbers for that particular face or surface are applied to the processor.

The operation of the basic current-mode gate is shown in the figure. When the base of Q_1 (the output) is at a low voltage with respect to the reference, the emitter resistor R will carry a current whose magnitude is determined by the values of R , $-E$, V_r , and the base emitter drop V_{BE} of Q_2 . With its base in the

"low" state, Q_1 will be off and the current in R will flow through Q_2 and through the load. If the base of Q_1 is switched to the high state, the current I will flow through Q_1 and the load will carry no current. If the magnitude of $-E$ is large compared to V_{BE} and to the signal swing, the current I will remain substantially constant and will be switched through Q_1 or through Q_2 , depending on the state of the input.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Manned Spacecraft Center
Houston, Texas 77058
Reference: B66-10429

Patent status:

No patent action is contemplated by NASA.

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under contract to
Manned Spacecraft Center
(MSC-781)